A REVIEW ON ROUTING PROTOCOLS FOR MOBILE ADHOC NETWORKS

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Abstract — **A mobile adhoc network is a wireless network connected with autonomous mobile nodes which are self-configured and dynamic. In these networks there is no fixed topology due to the mobility of nodes, interference, multipath propagation and path loss. Hence a dynamic routing protocol is needed for these networks to function properly. The widely accepted existing routing protocols designed to accommodate the needs of such self-organized networks. The contribution of this paper is to critically analyze most of the routing protocols and provide comparisons which are reported in the available literature. This will help in having a wider understanding of the problem domain and can also be used to develop or some new or to extend already proposed schemes.**

Keywords - MANET, Adhoc, AODV, DSR, TORA.

I. INTRODUCTION

An Ad-hoc network is a collection of mobile wireless nodes, forming a temporal network without the help of any centralized administration or some standard services help. . The nodes are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Routing is a core problem in networks for sending data from one node to another. In an Ad-hoc hierarchical network some nodes have transmission ranges larger than others, at least in some of their channels, this kind of stuff produce a traffic average abatement required by the node when the network size is incremented. Comparing with a normal network, the Ad-hoc wireless network have hand important game role with military applications. Equipped soldier with multi nodes wireless communicator could be communicated in an Ad-hoc network without wireless station regularization [1][2].

On Demand or Reactive Routing Protocols: In these protocols, routes are created as and when required. When a transmission occurs from source to destination, it invokes the route discovery procedure. The route

remains valid till destination is achieved or until the route is no longer needed. Some of the existing on demand routing protocols are: DSR [3][4], AODV [5][6] and TORA [7][8].

Table-Driven Routing Protocols (Proactive)

These protocols are also called as proactive protocols since they maintain the routing information even before it is needed [9].The proactive routing means that the routing information like next forwarding hope is maintained in the background irrespective of communication requests. The packets are constantly broadcast and flooded among nodes to maintain the path, than a table is constructed within a node which indicates next hop node towards a destination. Each and every node in the network maintains routing information to every other node in the network. Routes information is generally kept in the routing tables and is periodically updated as the network topology changes. The advantage of proactive routing protocols is that there is no route discovery is required since the destination route is stored in the background, but the disadvantage of this protocol is that it provides low latency for real time application, it also leads to the maintenance of unused data paths, which causes the reduction in the available bandwidth. Many of these routing protocols come from the link-state routing [10]. There exist some differences between the protocols that come under this category depending on the routing information being updated in each routing table. Furthermore, these routing protocols maintain different number of tables. The proactive protocols are not suitable for larger networks, as they need to maintain node entries for each and every node in the routing table of every node. This causes more overhead in the routing table leading to consumption of more bandwidth. In Table Driven routing protocols each node maintains one or more tables containing routing information to every other node in the network. All nodes keep on updating these tables to maintain latest view of the network. Some of the existing table driven or proactive protocols are: DSDV [11][12].

DSR Protocol [13][14].

The DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. Dynamic Source Routing (DSR) is one of the more generally accepted ad hoc routing protocols. As the name indicates, it utilizes source-based routing rather than table-based, and it is source-initiated rather than hop-by-hop. When a node wishes to establish a route, or issues a Route Request to all of its neighbors. Each neighbor rebroadcasts this Request, adding its own address in the header of the packet. When the Request is received by the destination or by a node with a route to the destination, a Route Reply is generated and sent back to the sender along with the addresses accumulated in the Request header. DSR has the advantage that no routing tables must be kept to route a given packet, since the entire route is contained in the packet header. The caching of any initiated or overheard routing data can significantly reduce the number of control messages being sent, reducing overhead. Using only triggered updates furthers that same goal.

Benefits and Limitations of DSR

One of the main benefit of DSR protocol is that there is no need to keep routing table so as to route a given data packet as the entire route is contained in the packet header. The limitations of DSR protocol is that this is not scalable to large networks and even requires significantly more processing resources than most other protocols. Basically, In order to obtain the routing information, each node must spend lot of time to process any control data it receives, even if it is not the intended recipient.

AODV Protocol [2][5][6]

The AODV algorithm is an improvement of DSDV protocol. Ad Hoc On-Demand Distance Vector allows mobile terminals to get many of paths, and will soon arrive at the destination that it wants. Moreover, it does not require these mobile terminals maintain these path of destination end when their communication services are not been activated. It will also allow the mobile terminals quickly respond when the link has been disconnected and the network topology is changed, and then make some measures. AODV routing protocol is also based on distance vector, the serial number is also used to indicate the new or old condition of routing. AODV only requires the host to maintain an effective routing. The so-called effective routing is means that nodes at least send a datagram routing in effective time of past. When the terminal datagram is need to reach a destination node and does not have an effective routing, it will broadcast a RREQ request routing information and transmit in flood. When the request information is received by destination node, or middle node of destination node which have path to arrive, then routing has been found. RREP routing response was sent back to each sender of RREQ to establish routing. Each routing will be end after an effective lifetime of prior decisions. Through routing send, a datagram will reset useful lifetime of the routing.

Benefits and Limitations of AODV

The benefits of AODV protocol are that it favors the least congested route instead of the shortest route and it also supports both unicast and multicast packet transmissions even for nodes in constant movement. It also responds very quickly to the topological changes that affects the active routes. AODV does not put any additional overheads on data packets as it does not make use of source routing. The limitation of AODV protocol is that it expects/requires that the nodes in the broadcast medium can detect each others' broadcasts. It is also possible that a valid route is expired and the determination of a reasonable expiry time is difficult. The reason behind this is that the nodes are mobile and their sending rates may differ widely and can change dynamically from node to node. In addition, as the size of network grows, various performance metrics begin decreasing. AODV is vulnerable to various kinds of attacks as it based on the assumption that all nodes must cooperate and without their cooperation no route can be established.

Temporally Ordered Routing Algorithm (TORA)[7][8][15]

Temporally Ordered Routing Algorithm (TORA) routing belongs to a family of link reversal routing algorithms where a directed acyclic graph (DAG) toward the destination is built based on the height of the tree rooted at the source. The directed acyclic graph directs the flow of packets and ensures reach ability to all nodes. When a node has a packet to send, it broadcasts the packet. Its neighbor only broadcasts the packet if it is the sending node's downward link based on the DAG. A node would construct the directed graph by broadcasting a query packet. Upon receiving a query packet, if a node has a downward link to the destination, it will broadcast a reply packet; otherwise, it simply drops the packet. A node, upon receiving a reply packet, will update its height only if the height from the reply packet gives the minimum of all the heights from reply packets it has received so far. It then rebroadcasts the reply packet.

Benefits and Limitations of TORA

One of the benefits of TORA is that the multiple routes between any source destination pair are supported by this protocol. Therefore, failure or removal of any of the nodes is quickly resolved without source intervention by switching to an alternate route. TORA is also not free from limitations. One of them is that it depends on synchronized clocks among nodes in the ad hoc network. The dependence of this protocol on intermediate lower layers for certain functionality presumes that the link status sensing, neighbor discovery, in order packet delivery and address resolution are all readily available. The solution is to run the Internet MANET Encapsulation Protocol at the layer immediately below TORA. This will make the overhead for this protocol difficult to separate from that imposed by the lower layer.

DSDV Protocol [11][12][16]

The DSDV described is a table-driven proactive protocol, the basic improvements made include freedom from loops in routing tables, more dynamic and less convergence time. DSDV protocol is based on the classical Bellman-Ford routing algorithm, and is similar to the RIP (Routing Information Protocol) protocol of the fixed network. DSDV set serial number for each router, help nodes to distinguish expired node routing information from valid information, and avoid the emergence of routing loop. DSDV transmit data between the terminals by saving routing tables of every terminal. There are two modes for this protocol to exchange messages of routing table, time-driven and event-driven. Each node will periodically send the local routing table to adjacent nodes; or when the routing table changes, it will also send the routing information to adjacent nodes. New packet length can be adjusted with the mobile node. When there is no moving node, routing updates are carried out by use of data packet of longer interval (including a number of data units). When nodes are moving, use smaller packets, and only update the routing information of moving nodes, and this reduces the overall cost.

Hybrid Routing Protocols

Hybrid routing protocols are proposed to combine the merits of both proactive and reactive routing protocols and overcome their shortcomings. Normally, hybrid routing protocols for mobile ad hoc networks exploit hierarchical network architectures. Proper proactive routing approach and reactive routing approach are exploited in different hierarchical levels, respectively. ZRP, HSR

The Zone Routing Protocol (ZRP)[17][18]

The Zone Routing Protocol (ZRP) is a hybrid routing protocol for mobile ad hoc networks. The hybrid protocols are proposed to reduce the control overhead of proactive routing approaches and decrease the latency caused by route search operations in reactive routing approaches. In ZRP, the network is divided into routing zones according to distances between mobile nodes. Given a hop distance d and a node N, all nodes within hop distance at most d from N belong to the routing zone of N. Peripheral nodes of N are N's neighboring nodes in its routing zone which are exactly d hops away from N.

The Hierarchical State Routing (HSR)[19]

The Hierarchical State Routing (HSR) is a multi-level cluster-based hierarchical routing protocol. In HSR, mobile nodes are grouped into clusters and a cluster head is elected for each cluster. The cluster heads of low level clusters again organize themselves into upper level clusters, and so on. Inside a cluster, nodes broadcast their link state information to all others. The cluster head summarizes link state information of its cluster and sends the information to its neighboring cluster heads via gateway nodes. Nodes in upper level hierarchical clusters flood the network topology information they have obtained to the nodes in the lower level clusters.

II. COMPARSION[20][21][22][23]

As reactive routing protocols for mobile ad hoc networks, DSR, AODV and TORA are proposed to reduce the control traffic overhead and improve scalability. Both DSR and TORA support unidirectional links and multiple routing paths, but AODV doesn't. In contrast to DSR and TORA, nodes using AODV periodically exchange hello messages with their neighbors to monitor link disconnections. This incurs extra control traffic overhead. In TORA, utilizing the "link reversal" algorithm, DAG constructs routing paths from multiple sources to one destination and supports multiple routes and multicast. In AODV and DSR, a node notifies the source to re-initiate a new route discovery operation when a routing path disconnection is detected. In TORA, a node re-constructs DAG when it lost all downstream links. Both AODV and DSR use flooding to inform nodes that are affected by a link failure. However, TORA localizes the effect in a set of node near the occurrence of the link failure. AODV performs better than DSR, TORA and DSDV because the average hop distance between the source-destination becomes high in AODV and this will increase packet overhead. So AODV protocols perform better under low and high mobility conditions.

protocols	FSR	AODV	DSR	TORA	ZRP	HSR
Routing discovery delay	No	Yes	Yes	Yes	Minimal	Yes
Routing philosophy	Proactive	Reactive	Reactive	Reactive	Hybrid	Hybrid
Structure	Flat	Flat	Flat	Flat	Flat	Hierarchical
Frequency update	Periodically	As needed(data traffic)	As needed(data traffic)	As needed(data traffic)	Periodically	
Scalability	Yes	No	No	No	Yes	No

TABLE I. Comparison between Routing Protocols

III. CONCLUSION

So far, the Ad hoc network routing protocols can be divided into table-driven routing protocols and on-demand routing protocols according to the different driver models of the discover routing. Table-driven routing protocols have smaller delay, but spend too much on network costs and are difficult to adapt to the characteristic of frequent changes in network topology. The study reveals that, DSDV routing protocol consumes more

bandwidth, because of the frequent broadcasting of routing updates. While the AODV is better than DSDV as it doesn't maintain any routing tables at nodes which results in less overhead and more bandwidth. From the above, chapters, it can be assumed that DSDV routing protocols works better for smaller networks but not for larger networks. So, my conclusion is that, AODV routing protocol is best suited for general mobile ad-hoc networks as it consumes less bandwidth and lower overhead when compared with DSDV routing protocol. This paper presented a detailed performance comparison of important routing protocols for mobile ad hoc wireless networks. AODV and DSR are reactive protocol. Both reactive protocols performed well in high mobility scenarios than proactive protocol.

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